the firm's stock price are related to changes in the market price. If β is 1.0, then a 10 percent change in the market is associated with a 10 percent change in the price of the firm's stock in the same direction. If β is 1.5, then a 10 percent change in the market is associated with a 15 percent change in the price of the firm's stock. Firms whose βs are above one are riskier than the market as a whole.[4]

The next section uses the portfolio theory described here, to draw comparisons between cable operators and other firms.

III. Large cable operators' market risk relative to other firms

Value Line, which is an independent and widely used source of investment information, provides estimates of β for 3 cable operators. Table 1 shows those estimates and compares the Value Line estimates for cable companies to those for AT&T, GTE, and the Regional Bell Operating Companies. The β estimates should be interpreted as describing, in terms of unavoidable market risk, each company's risk relative to the market. The unavoidable market risk is the critical input to a firm's equity cost of capital. Thus, for example, Cablevision's market risk is 35 percent higher than the risk premium of the market as a whole, and its equity cost of capital is higher than the risk free rate by 135 percent of the risk premium associated with the equity market as a whole.

Table 1 also indicates that the three cable companies have much higher values of β than do telephone companies. Hence, cable companies are riskier investments than telephone companies and must earn a higher rate of return to attract capital. It follows that the allowed rate of return for cable companies must exceed the allowed rate for telephone companies.

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4 The CAPM β is used to estimate a firm's equity cost of capital as follows. To the risk-free rate is added a term accounting for the equity market's return in excess of the risk-free return. If β is 1.0, then the firm's equity cost of capital is simply the risk-free rate plus the market premium. If β is 1.5, then the firm's equity cost of capital is the risk-free rate plus the market premium multiplied by 1.5. This relation is described algebraically as $R_C = R_f + \beta(R_m - R_f)$, where R_C is the firm's cost of capital, R_f is the risk-free rate, and R_m is the market rate of return.

Table 1:
Value Line Estimates of β for Cable and Telephone Companies[5]

Company	β
Cable	
Cablevision	1.35
Comcast	1.55
Tele-Communications Inc.	1.55
Telephone	
AT&T	.95
Ameritech	.85
Bell Atlantic	.95
Bell South	.85
GTE	.90
Nynex	.85
Pacific Telesis	.90
Southwestern Bell	.95
U.S. West	.90

IV. Estimates of the market risk of large cable operators

To verify the Value Line estimates of β and to obtain more estimates, we estimated β for the six large cable operators for which data necessary to calculate relevant and reliable β estimates were available.[6] Three of the firms are the same as those estimated by Value Line.

The coefficient β can be estimated from the regression equation,

$$R_C = a + \beta * R_m,$$

where a and β are estimated coefficients, and R_C and R_m are the rate of return on the individual cable operator and on the market. We used the S&P

5 Value Line, "Summary of Advice and Index," May 7, 1993.

6 The firms chosen were in the list of cable operators in Kagan, *The Cable TV Financial Databook*, June 1993. For inclusion, 80 percent of the firm's revenue must have been cable revenue, and the stock must have been trading regularly enough to allow reliable regression estimation. The six firms are Adelphia, Cablevision, Century, Comcast, Jones Intercable, and TCI.

500 to represent the market rate of return.[7] We estimated the regression using weekly data from June 2, 1989, to August 12, 1993.

For the cable operators examined here, the market risk of individual cable operators exceeds the risk in the market as a whole, generally by 30 to 50 percent.[8] Significant differences exist, however, among the βs for individual cable companies; they range from a minimum of 1.03 to a maximum of 1.53. Such differences in β suggest that different cable companies have very different costs of equity. Therefore it would be inappropriate to apply a uniform statutory cost of equity to all cable operators.

V. Conclusion

Using risk premium analysis to estimate the cost of equity reveals that large cable operators are riskier than AT&T, GTE, and the Regional Bell Operating Companies. This higher risk must be compensated for by allowing a higher rate of return on equity for cable operators than is allowed for telephone companies. The analysis also indicates that the level of risk varies among cable operators and that the cost of equity needs to be determined on a case-by-case basis.

These results, moreover, reach beyond the equity cost of capital for large cable companies, and have significant implications for the cost of debt capital, and for smaller cable operators. Other things equal, an operator with high equity costs is also likely to have high debts costs. And the cost of capital for smaller cable operators is likely to be higher than that for large operators.

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7 We also estimated βs using the S&P 400 as the market rate of return, but the results were not significantly different, so they are not displayed. Because the S&P 500 is based on a wider selection of firms, results using that index are preferable.

8 Our β estimates for Cablevision, Comcast, and TCI are very similar to those obtained by Value Line. All six estimates are significant at the 95 percent level.

ATTACHMENT H

"Evaluation of FCC Methodology for 1994 Rate Order"

Arthur D. Little, Inc.

June 1994

Arthur D Little

Arthur D Little

Evaluation of FCC Methodology for 1994 Rate Order

Report to National Cable Television Association (NCTA)

June 1994

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Reference 46535

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I. Executive Summary

A. Overall Conclusion

The FCC lacks a valid analytical basis for its guidelines to reduce cable TV rates, now being implemented in the Commission's "1994 Rate Order"[1].

An estimated price differential between competitive and non-competitive cable franchises is fundamental to the FCC's guidelines on cable rates. Arthur D. Little, Inc.'s evaluation of the FCC's methodology, conducted at the request of the National Cable TV Association (NCTA), concludes that the FCC's estimation of a competitive price differential is invalid. As a result, the FCC's guidelines are now called into question.

We find that:

- The FCC's price differential applies only to franchises that are part of small cable systems[2] which are non-representative of the industry.
- When we take cable system size into account in calculating the competitive price differential, which the FCC failed to do, we find the differential reduced almost to zero.
- Many of the small-system franchises in the FCC's competitive sample are commercially non-viable or otherwise atypical of the industry in their financial structure. Nevertheless, such franchises contribute to establishment of rate guidelines for the entire cable industry.

B. Background on FCC Rate-Setting Approach

The FCC employs a statistical model to determine effects of competition on cable rates, using cable franchise data collected from a survey of system operators. These data define attributes of 370 cable franchises defined as non-competitive, and of 50 others deemed to be operating in competitive markets.

In comparing competitive and non-competitive franchises in its sample, the FCC's model estimates that competition is responsible for a 17 percent differential in cable rates. The Commission directs cable operators to reduce their rates to competitive benchmarks calculated for each franchise using the FCC model individualized with franchise-specific attributes.

[1] Second Order on Reconsideration, Fourth Report and Order and Fifth Notice of Proposed Rulemaking ("1994 Rate Order"), MM Docket No. 92-266, March 30, 1994.

[2] Many cable systems, especially small systems, serve only one franchise area; however, many other systems serve multiple franchise areas. We generally refer in our report to a franchise as "part of" a cable system, even though it may represent the total operations of the cable system.

C. Arthur D. Little Assessment

We performed statistical analyses on the FCC's cable franchise data; we interviewed operators of cable systems in the FCC's sample; and we analyzed the financial performance of many of these systems. These steps produce consistent findings that indicate significant issues concerning the FCC's methodology.

1. Source of Competitive Price Differential

The competitive price differential estimated by the FCC derives primarily from attributes of franchises that are part of small cable systems. Small systems are defined as serving fewer than 5000 subscribers; large systems are defined as serving 5000 or more subscribers.

Our analysis confirms findings reported in the "1994 Rate Order" and verified by the FCC, that there is no price differential between competitive and non-competitive franchises that are part of large cable systems.

Small cable systems serve a tiny minority (approximately 3 percent) of subscribers in the FCC's sample. The 292,000 subscribers served by these systems in the FCC's overall sample represent approximately 0.5% of the industry's 57 million subscribers.

Only 50,000 subscribers are served by small systems whose franchises are deemed by the FCC to be competitive; these subscribers represent less than 0.09% of the industry's subscribers. The 29 small competitive franchises in the FCC's sample represent 0.09% of the industry's 32,000 communities; the systems of which they are a part represent approximately 0.3% of the industry's 11,000 cable systems. The low average revenues of these 29 franchises are largely responsible for the FCC's competitive price differential.

In the cable industry, as in the FCC's sample, small systems are atypical in terms of the number of subscribers they serve; such systems serve less than 14 percent of the industry's total.

2. Relevance of Cable System Size

Small and large cable systems are not the same. Our analyses of the FCC sample data and of data collected in our own survey of operators of FCC-designated competitive systems, indicate that small systems typically have lower per-subscriber revenue requirements than large systems.

We find small and large systems' per-subscriber capital investments are comparable, but that small systems' market environments and operating expenses diverge in terms of:

- lower income level in their communities
- fewer local TV broadcast stations
- fewer satellite channels offered
- lower proportion of addressable subscribers
- less overall channel capacity
- lower operating expenses

Despite these substantive and relevant differences between small and large systems, the FCC's pricing guidelines for the entire cable industry are based entirely on average revenues of small systems in the FCC's sample.

3. Effect of Not Properly Accounting for System Size

By not appropriately taking into account the size of cable systems in its estimation of the competitive price differential, the FCC vastly inflates the impact of the outcomes for the very small systems.

The competitive price differential disappears when we run the FCC's own regression model, using the FCC's database, but weight each observation in the FCC's sample by size of system.

4. Commercial Viability of Franchises in the Competitive Sample

Many franchises in the FCC's competitive sample demonstrate poor financial performance. Most of these franchises are part of small systems which perform poorly despite their lower cost structure vis-a-vis larger systems. This may be due to their relative inability to subsidize operations from a broad base of subscribers. Also they may be competing more as commodity cable providers, where price is the only differentiator, versus larger systems which can also compete on features such as longer customer service hours, more programming choices, and enhanced services.

Using the FCC's own financial guidelines[3], plus financial data collected in our survey, we show that some of these franchises are producing returns that are inadequate for private investors. In part because their rates are too low, they lack resources for needed reinvestment and even, in some cases, for servicing of their debt.

[3]Report and Order and Further Notice of Proposed Rulemaking ("1994 Cost of Service"), MM Docket No. 93-215, March 30, 1994. The FCC provides assumptions to be used by cable operators for interest rate (p.102), debt leverage (p.106), rate of return (p.108), and tax expense (p.83).

Such systems have dubious long-term prospects. Low average revenues reported by such systems nevertheless are allowed to contribute to the FCC's estimation of a competitive price differential.

5. Atypical Market Situations in FCC Sample

Since the date of the FCC survey, franchises in the FCC's competitive sample have experienced mergers and acquisitions eliminating competition in their markets.

Our survey also reveals various forms of external subsidy to several of the franchises with particularly low average regulated revenues. Such subsidies include public financing, concessionary debt repayment arrangements, and bank debt repayments via a major shareholder's personal loans to the system.

Several of the franchises in the sample appear close to extinction, for example serving only 28, 58, or 75 subscribers, and are no longer being adequately maintained.

Despite their small size, uncertain market longevity, and other symptoms of non-viability over an extended period, these franchises influence the FCC's estimation of rate guidelines for the cable industry.

D. Evaluation

Methodological errors and non-representativeness of the FCC's sample undermine the Commission's guidelines to reduce cable rates. We conclude that the FCC's methodology underpinning its "1994 Rate Order" is invalid; that the Commission's estimate of a competitive price differential is likely to be overstated; and that it is unreasonable to apply the FCC's current rate guidelines to the cable industry.

II. Background

A. Arthur D. Little Objective

Arthur D. Little Inc. was asked by the National Cable Television Association (NCTA) to evaluate the methodology used by the FCC for its rulemaking on cable TV rates.

This methodology was used by the FCC to calculate a 17 percent differential between "effectively competitive and noncompetitive cable rates," as reported in the March 1994 Second Order on Reconsideration, Fourth Report and Order and Fifth Notice of Proposed Rulemaking ("1994 Rate Order")[4]. Based on this result, the FCC directs cable operators to reduce their rates to prescribed competitive levels.

A valid methodology is essential to support and explain the FCC rules on cable rates. Otherwise, these rules would be arbitrary, with unforeseen consequences for the cable industry and for the public. The FCC's methodology is valid if it meets the following criteria:

- Correct use of appropriate analytic techniques on data that are representative of the cable industry
- Correct application of results to the population of cable systems
- Due consideration of any relevant special attributes of franchises in the sample

We assess the FCC's methodology vis-a-vis each of these criteria.

B. FCC Methodology to Prescribe Cable Rates

To provide a framework to describe our evaluation of the FCC's methodology, we summarize here the key elements of the FCC's approach. In particular, we have referred to attachments to the 1994 Rate Order including "FCC Cable TV Rate Survey Database, Structure of Database and Explanatory Notes," and "Appendix C -- Technical Appendix."

1. Sources of FCC Data

Most of the FCC's data were obtained from a survey of cable system operators conducted between December 1992 - February 1993, concerning attributes of franchises as of September 1992. Additional data were obtained from the 1990 decennial Census of Population and Housing. The 234 variables in the database describe attributes of each franchise.

[4] Second Order on Reconsideration, Fourth Report and Order and Fifth Notice of Proposed Rulemaking ("1994 Rate Order"), MM Docket No. 92-266, March 30, 1994.

2. FCC Sample

Questionnaires were mailed to operators of franchises in the following categories:

- 1 percent random sample of franchises
- Franchise areas believed by the FCC to be subject to competition from more than one multichannel video provider
- Franchises expected to have less than 30 percent penetration
- Franchises that are part of the industry's 100 largest systems.

The FCC survey generated 687 responses; of these, 420 provided data on a second franchise area; thus, the FCC started with a sample of 1107 franchises. Many observations were deleted by the FCC on various grounds, including (a) franchises determined not to be subject to effective competition, (b) second franchise areas of systems in the random sample, (c) franchises that are part of the 100 largest systems, unless they remain in the sample for other reasons.

Following these deletions, the database used in the current analysis comprises 496 franchise observations. After excluding 76 additional franchises because of missing data, the FCC's final sample used in its analysis comprises ***420 franchises***:

- ***370 in the non-competitive sample***
  - **237** non-competitive franchises
  - **133** "low penetration" franchises, initially classified as "competitive" by the FCC but counted in the "non-competitive" sample for purposes of the current analysis
- ***50 in the competitive sample***
  - **39** with private overbuilds (including 11 "low penetration" franchises)
  - **11** with municipally-operated overbuilds (including 4 low penetration franchises)

Sample construction is an extremely important step affecting validity of research findings. The FCC's sample is the source for the Commission's inferences and for its estimation of competitive cable rate benchmarks. In Appendix 1, which describes our statistical analyses, we comment on potentially serious sampling problems. However, our primary focus for this assignment is on other aspects of the FCC's methodology.

3. Database Variables

Database variables include information for each franchise and for the system of which the franchise is a part. These variables, based on data collected in the FCC's survey questionnaires, include:

- **Household and Subscriber Data**
  Households in the area; Households passed; Households subscribing to cable; Addressable subscribers

- **Physical Plant Data**
  Number of head-ends serving system; Age of principal head-end; Line miles of distribution plant; Proportion of miles above ground, below ground and fiber

- **Ownership**
  Owned by MSO; Number of systems in MSO

- **Subscription Revenues**
  By tiers and from various sources

- **Market Status**
  Franchises with less than 30 percent penetration; Multi-channel competitors in market area; Municipally-operated competitors; Percentage of households in area offered competitive services

- **Franchise Fees**
  Amount; How calculated and incurred

- **Rates**
  Equipment; Basic tier; Second tier; Third tier

- **Services Offered**
  By type of channels carried on Basic, Second and Third tiers

Additional variables, from the census, include median household income, and other demographic attributes associated with the ZIP codes matched to the franchise areas.

The FCC constructed additional variables from data provided by the cable operators. The two most significant are:

- the FCC's dependent variable, called ARIEPS, for average regulated revenue per subscriber including equipment revenues
- the FCC's key independent variable representing market competitiveness, called OVL, for the estimated proportion of households passed in the system that are also passed by a competitor.

Although the FCC database provides a substantial amount of useful information about each franchise and system, it is incomplete because the FCC did not ask directly for information on capital investment or operating expenses, factors relevant to a franchise's revenue requirements. The FCC database provides partial but insufficient indicators of investment (i.e., channel capacity, addressability, density), and of operating expenses (i.e., number of satellite channels).

In the end, the FCC's ultimate regression equation excludes several of these key investment and operating expense indicators.

4. FCC Analysis

The Commission uses regression analysis to estimate the effect of competitive market structure on cable rates. Market competitiveness is represented by OVL. The dependent variable, ARIEPS, serves as the proxy for cable rates charged for regulated services. The FCC reports that it tried many different equations before settling on one with the following independent variables:

- Competitive overlap (OVL)
- Log of median income
- MSO ownership (dummy variable)
- Log of MSO size
- Reciprocal of number of subscribers in the system
- Reciprocal of average total channels
- Proportion of non-broadcast channels
- Proportion of additional outlets
- Proportion of remotes
- Proportion of Tier 2 subscribers
- Proportion of Tier changes
- Low penetration (dummy variable)
- Municipal franchise (dummy variable)

The coefficient of the competition variable OVL, as a predictor of ARIEPS, is -.174. The FCC concludes that market competitiveness, as experienced by the 50 franchises in the competitive sample, is associated with approximately 17 percent lower average revenues per subscriber.

The FCC stipulates this price differential as a target for reduction of rates by virtually all cable systems in the industry.

5. Implementation of FCC Rules

Each cable operator, equipped with the FCC's model, is required to calculate average allowable regulated revenues per subscriber. Variables in the model, such as size of MSO, reciprocal of the number of subscribers in the system, and median income in the community, contribute to estimation of franchise-specific pricing benchmarks, based on the model's estimated coefficients.

The FCC's statistical assumptions and procedures are key to the validity of its analytical conclusions. Significant issues concerning the FCC's statistical methodology are discussed in Appendix 1.

III. Evaluation of FCC Methodology

The FCC has made serious efforts to develop objective standards to implement objectives of the 1992 Cable Act[5]. They have conducted extensive research and analysis in order to determine and to justify specific cable rate benchmarks that can be applied on an individual basis to cable franchises. They have diligently collected industry data and have applied sophisticated analytical techniques.

However, serious shortcomings in the FCC's approach undermine the validity of their conclusions and the rate guidelines being imposed on the cable industry.

A. Arthur D. Little Analyses

Our conclusions are based on a combination of statistical analyses of the FCC's database, primary research, and financial analyses.

1. Statistical Analysis

We analyze the FCC database using several statistical techniques, as described in detail in Appendix 1. We focus in particular on variables related to economic and technology attributes of the franchises, including several ratios and combinations of FCC variables that we employ to highlight common cable industry measures:

- ***Market Area***
  - Median household income (INCOME)[6]
  - Basic tier local TV broadcast stations (S7_1LTV)
  - Other tier (2&3) local TV stations (S7_2LTV+S7_3LTV)

- ***Cable System: Density***
  - Households passed per mile (S2_HHPAS÷S2_MILES)
  - Subscribers per mile (S2_HHSUB÷S2_MILES)
  - Subscribers per homes passed (S2_HHSUB÷S2_HHPAS)

- ***Cable System: Investment and Cost***
  - Addressable subscribers (S2_ASUBS)
  - Age of principal headend (S2_AGEHE)
  - Miles of plant (S2_MILES)
  - Percentage aerial miles (S2_PABOV)
  - Percentage underground miles (S2_PBELO)
  - Percentage fiber miles (S2_PFIBE)
  - Requirement to bury drops (S2_BURY)
  - MSO owned (S2_PARTM)

[5]It is not within our scope in this assignment to comment the FCC's interpretation of the 1992 Cable Act objectives.

[6] Bracketed variable names are as identified in the FCC database. Several new variables are constructed from multiple FCC variables, e.g., household density (subscribers per mile) is derived by dividing system subscribers (S2_HHSUB) by miles of plant (S2_MILES).

- Number of MSO systems (S2_MSONU)
- Addressability (S2_ASUBS÷S2HHSUB)

- ***Franchise Area: Density***
  - Households passed per mile (S5_HHPAS÷S5_MILES)
  - Subscribers per mile (S5_HHSUB÷S5_MILES)
  - Subscribers per homes passed (S5_HHSUB÷S5_HHPAS)

- ***Franchise Area:Investment***
  - Addressable subscribers (S5_ADDRS)
  - Age of principal headend (S5_HEADA)
  - Line miles of distribution plant (S5_MILES)
  - Percentage aerial miles (S5_PABOV)
  - Percentage below ground (S5_PBELO)
  - Percentage fiber miles (S5_PFIBE)
  - Requirement to bury all cable drops (S5_BURY)
  - Average number of converter boxes rented (S7_FYACB)
  - Average number of remote control units rented (S7_FYARC)
  - Addressability (S5_ADDRS÷S5_HHSUB)

- ***Franchise Area: Cost***
  - Franchise fees (S6_FPAID)
  - Other fees to franchise authority (S6_$0, or S6_0%)
  - Basic tier distant TV broadcast stations (S7_1DTV)
  - Basic tier satellite-delivered cable channels (S7_1SAT)
  - Other tier (2&3) distant TV broadcast stations (S7_2DTV+ S7_3DTV)
  - Other tier (2&3) satellite-delivered cable channels (S7_2SAT+S7_3SAT)
  - Total all channels (S7_TOTAC)

2. Arthur D. Little Survey

We interviewed operators of the 50 franchises in the FCC's "competitive" sample during April - June 1994, to supplement the FCC data with information on franchise technology and economic factors that were only partially obtained or not collected at all by the Commission. Interview topics are summarized in Table III-1.

Table III-1. Arthur D. Little Survey Topics

Franchise Technology	Franchise Economics
• Addressability • Channel capacity • Local studios • Other franchise requirements • Satellite-delivered cable networks • Channels added since 9/92 • Date of original construction	• Subscribers • Employees • Acquisition and/or original construction cost • Annual investment • Current rates • Financial performance - revenues, expenses, cash flow, depreciation

Primary research materials, including a copy of the Interview Guide, and summaries of the survey results, are attached in Appendix 2.

3. Financial Analyses

Data provided by many of the franchise operators are used to calculate their operating income and cash flow margins. We then construct simple financial models using these data, adhering to financial assumptions provided by the FCC[7], to evaluate financial performance of the franchises.

B. Assessment of Representativeness of FCC Results

In this section, we address the Commission's failure to account properly for size of cable system, focusing on the following points which suggest that the FCC's methodology does not produce results that are valid for most of the cable industry:

- Small systems produce the competitive price differential estimated by the FCC
- Small systems serve a tiny minority of subscribers in the FCC's database and in the industry
- The FCC did not properly account for system size in calculating the competitive price differential
- Small and large systems differ on economic and technology factors
- Small systems have a lower cost structure

[7] Report and Order and Further Notice of Proposed Rulemaking ("1994 Cost of Service"), MM Docket No. 93-215, March 30, 1994. The FCC provides assumptions to be used by cable operators for interest rate (p.102), debt leverage (p.106), rate of return (p.108), and tax expense (p.83).

1. Small Systems Produce Competitive Price Differential

The competitive price differential calculated by the FCC derives primarily from "competitive" and "non-competitive" franchises in the FCC's sample that are part of ***small*** cable systems, which we define as systems serving fewer than 5000 subscribers[8].

NCTA submitted an analysis in 1993 demonstrating a price differential only for small systems. This analysis was replicated by the FCC. In the "Appendix C--Technical Appendix" to the "1994 Rate Order," the FCC states it was able to replicate results of commentators that the:

> "...competitive [price] differential was large and statistically significant for small cable systems but statistically insignificant for large cable systems." (p.23)

We also tested this question using the FCC's database which includes the following cable franchises:

	Small Systems	Large Systems	Total
Non-Competitive Franchises	207	163	370
Competitive Franchises			
• **Overbuilds**	19	20	39
• **Municipals**	10	1	11
Total	236	184	420

Our analysis demonstrates the same result as found by the NCTA and FCC. As shown in Table III-2, which tabulates ARIEPS (the FCC's dependent variable for average revenues) against size of cable systems, there is a price differential only for franchises that are part of small cable systems.

[8]This size breakpoint is close to the median in the FCC's database; it is one of the levels found in cable industry databases to distinguish cable systems by size; it was used by previous commentators in this proceeding; and it classifies franchises into groups that are found to be different to a significant degree in terms of highly relevant characteristics.

Table III-2. Average Revenues per Subscriber (ARIEPS) in FCC Sample

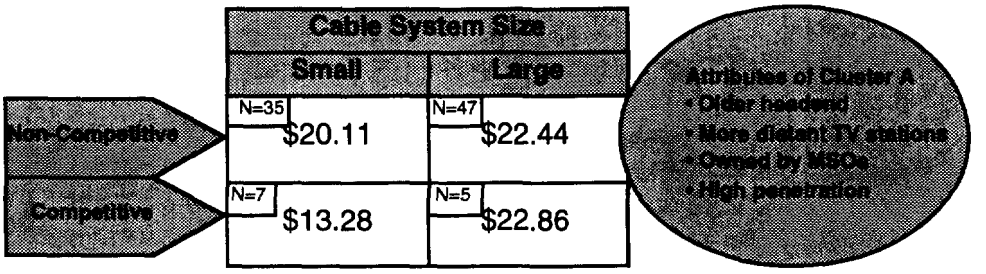
	Cable System Size	
	Small	Large
Non-Competitive (N=370)	N=207 $21.09	N=163 $22.58
Competitive (N=50)	N=29 $15.39	N=21 $22.12

We also use *cluster analysis* to assemble subgroups of franchises based on economic and technology similarities, and then compare ARIEPS for small and large systems within these otherwise homogeneous groupings. Our use of this technique is described in Appendix 1.

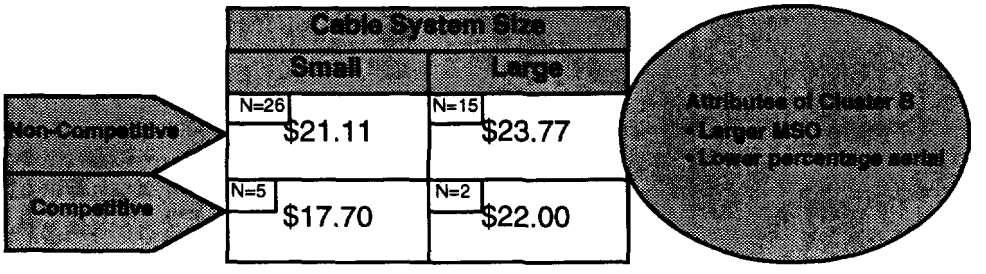
Four groupings emerged. As summarized in Chart III-1, in Clusters A, B, and D, significantly lower ARIEPS is found only for competitive franchises that are part of small cable systems. Cluster C also shows a lower ARIEPS for the small competitive observations, but in addition shows this result, albeit less strongly, for large competitive systems (with, however, only 2 observations in the latter group).

Chart III-1. ARIEPS Differences Within Franchise Clusters

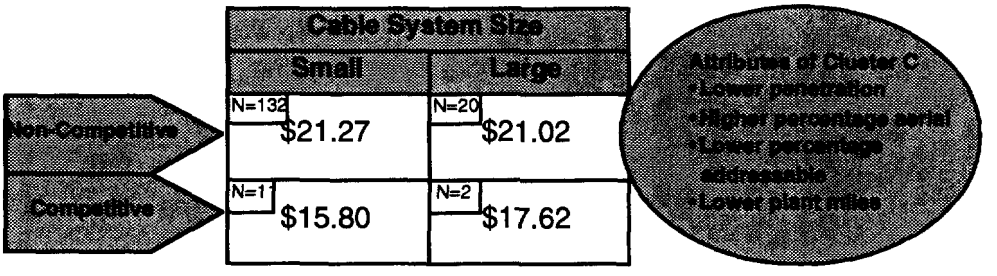
Average Revenues Per Subscriber (ARIEPS) in Cluster A



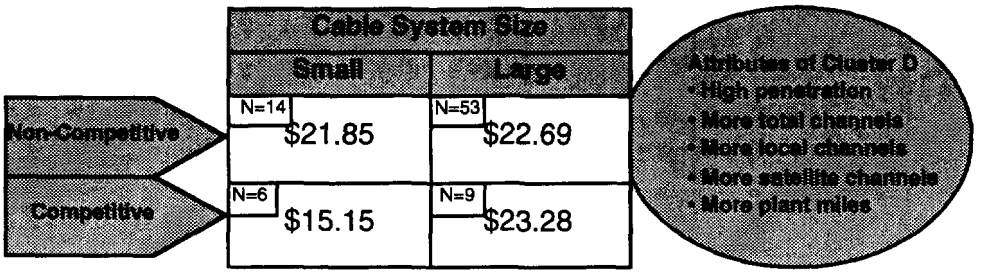
Average Revenues Per Subscriber (ARIEPS) in Cluster B



Average Revenues Per Subscriber (ARIEPS) in Cluster C



Average Revenues Per Subscriber (ARIEPS) in Cluster D



These different techniques confirm that the competitive price differential appears only among franchises that are part of small cable systems[9].

This presents a serious problem for the FCC's methodology because:

- Small cable systems serve a very small proportion of subscribers in the cable industry
- Small and large cable systems differ on factors relevant to revenue requirements

2. Small Systems Serve Minority of Subscribers

Television & Cable Factbook. (1993 Edition, p. F-3) notes that larger systems serve more than 86 percent of the U.S. cable subscribers. Small systems serve less than 14 percent. The FCC's sample shows this skewed distribution even more strongly. Although the majority of franchises in the FCC sample are part of smaller systems, these systems serve only 3 percent of the total subscribers in the FCC's database, as summarized below:

Sample	Competitive	Non-Competitive
Total Franchises	50	370
% Small Systems	58%	56%
Total Subscribers	983,300	8,271,000
% Large System Subs (In systems >5000)	95%	97%
% Small System Subs (In systems <5000)	5%	3%

Thus, the FCC's "1994 Rate Order" for an industry serving over 57 million subscribers[10] is based on pricing by franchises that are part of systems reaching approximately 300,000 subscribers, equivalent to 0.5% of the industry total.

[9]In the Technical Appendix to the 1994 Rate Order, the FCC speculates that operators of large competitive systems may collude to maintain higher rates. It is unclear why this should be easier for large systems than for small systems. Another explanation is just as plausible:

- Large systems in "non-competitive" markets face competition from substitutes, including a broader range of local TV broadcast stations; thus their rates, already constrained by market forces even without local multichannel overbuilds, are similar to rates charged by systems in such "competitive" markets

- Small systems in non-competitive markets are less subject to competition from substitutes, although this is now changing with introduction of DBS services, and they have been able to charge higher rates as a result. At the same time, the "competitive" small-system franchises are compelled to reduce rates even below their revenue requirements, because their commodity cable channels can be differentiated only on price, and because some face subsidized or otherwise financially atypical competitors.

[10]Estimates of industry size currently range from 57 million subscribers to 59 million (*Cable Television Developments*, NCTA, April 1994, p.1A). For purposes of this comparison, we have selected the lower number.

3. FCC Did Not Properly Account for System Size

The FCC did not properly take into account differing cable system sizes in estimating the competitive price differential.

Our test of weighting each observation in the FCC's sample by cable system size, using the FCC's regression model and the FCC's database, shows that the competitive price differential is reduced to virtually zero; as described in Appendix 1, the coefficient for OVL in this instance is 0.002.

We verify the significance of cable system size as a predictor of ARIEPS using analysis of variance (ANOVA), as described in Appendix 1. We re-classify the FCC sample into three size groups: systems serving fewer than 3000 subscribers, between 3000-15000, and more than 15,000. This analysis shows ARIEPS monotonically increasing with system size. Very small systems serving fewer than 3000 subscribers exhibit significantly lower revenues regardless of competitive status. Thus, comparisons *only* of the main effects, i.e., competitive versus non-competitive, are misleading. Competitive status and size interact in predicting ARIEPS; they are not independent predictors. Therefore, application of rate benchmarks to cable franchises must necessarily and explicitly take into account size as well as competitive status in order to be meaningful.

4. Technology and Economics Distinguish Small and Large Systems

In declining to explore the implications of findings that the competitive price differential appears only among small cable systems, the FCC states:

> "...we know nothing about the technology or economics of cable systems to suggest a rationale for the choice of size classes" (Appendix C - Technical Appendix, "1994 Rate Order," p.23).

If small and large systems are alike on attributes relevant to their revenue requirements, the FCC's comment would be appropriate. However, our analysis focusing on cost and investment factors that were neither included, nor considered as candidates, in the FCC regression model, shows that franchises operated by small and large systems are not alike.

We find there are significant economic and technology differences between small and large cable systems. Differences in revenue (e.g., as measured by ARIEPS) can be explained, at least in part, by differences in economic factors.

Simple tabulations of relevant variables illustrate significant differences in economic factors (e.g., median market income, local TV stations) and technology factors (homes passed per mile, total channel capacity, and addressability).

Franchises operated by small cable systems, as highlighted in Table III-3, are associated with:

- Lower market income
- Fewer homes passed per mile
- Fewer local TV broadcast stations
- Less channel capacity[11]
- Lower proportion of subscribers with addressable converters

Table III-3. Differences in Economic and Technology Factors

	Small Cable Systems	Large Cable Systems
Median Market Income		
• Non-Competitive	$23,700	$32,000
• Competitive		
- Overbuilds	$21,700	$32,500
- Municipals	$20,500	$25,600
Homes Passed per Mile		
• Non-Competitive	45.6	92.6
• Competitive		
- Overbuilds	46.1	92.1
- Municipals	63.6	63.3
Local TV stations		
• Non-Competitive	5.7	8.1
• Competitive		
- Overbuilds	5.8	8.3
- Municipals	5.3	3.0
Total channel capacity		
• Non-Competitive	26.2	44.6
• Competitive		
- Overbuilds	41.3	42.6
- Municipals	36.0	36.0
Addressable Subscribers (%)		
• Non-Competitive	7%	33%
• Competitive		
- Overbuilds	10%	30%
- Municipals	43%	0%

To explore more rigorously the relationships between size and economic factors, we use logistic regression analysis, as described in detail in Appendix 1. First, we examine the statistical significance of such factors considered individually; then, we determine which factors (if any) jointly predict the size of the cable system.

[11]In the FCC database, channel capacity is lower for small cable systems only in the non-competitive sample. However, our survey of *competitive* franchises also finds significantly fewer active channels provided by small-system franchises, as summarized in Table III-7, below.